



# Memphis Depot Environmental Restoration Program Dunn Field Remedial Action Information

The selected remedy for Dunn Field includes the remediation of disposal sites and associated subsurface soil, and groundwater contamination as well as volatile organic compound (VOC) contamination within subsurface soil that is outside of the disposal sites. The remedies will allow the transfer or lease of the Dunn Field property for its intended land use (industrial and recreational).

The major components of the selected remedy for Dunn Field include:

- Excavation, transport, and disposal of soil and material contained within disposal sites located in the western half of Dunn Field based upon results from a pre-design investigation into these sites. According to the Dunn Field Disposal Sites Remedial Design, Sites 3, 4.1, 10, 13 and 31 will undergo excavation, transport and disposal.
- Use of soil vapor extraction (SVE) to reduce VOC concentrations in subsurface soils to levels that are protective of the intended land use and groundwater.
- Injection of zero-valent iron (ZVI) within Dunn Field to treat chlorinated volatile organic compounds (CVOCs) in the most contaminated part of the groundwater plume, and installation of a permeable reactive barrier (PRB) to remediate CVOCs within the off site areas of the groundwater plume.
- Monitored natural attenuation (MNA) and long-term groundwater monitoring (LTM) to document changes in plume concentrations, to detect potential plume migration to offsite areas or into deeper aquifers, and to track progress toward remediation goals.
- Implementation of land use controls, which consist of the following institutional controls: deed and/or lease restrictions; Notice of Land Use Restrictions; City of Memphis/Shelby County zoning restrictions and the Memphis and Shelby County Health Department groundwater well restrictions.

These remedial actions will address the following Constituents of Concern:

**Benzene:** A COC in subsurface soil in the Disposal Area. Benzene is a colorless liquid with a sweet odor. It evaporates into the air very quickly and dissolves slightly in water. It is highly flammable and is formed from both natural processes and human activities. Benzene is widely used in the United States; it ranks in the top 20 chemicals for production volume. Some industries use benzene to make other chemicals which are used to make plastics, resins, and nylon and synthetic fibers. Benzene is also used to make some types of rubbers, lubricants, dyes, detergents, drugs, and pesticides. Natural sources of benzene include volcanoes and forest fires. Benzene is also a natural part of crude oil, gasoline, and cigarette smoke. Breathing very high levels of benzene can result in death, while high levels can cause drowsiness, dizziness, rapid heart rate, headaches, tremors, confusion, and unconsciousness. Eating or drinking foods containing high levels of benzene can cause vomiting, irritation of the stomach, dizziness, sleepiness, convulsions, rapid heart rate, and death. Benzene is a known human carcinogen.

**Copper:** A COC in subsurface soil in the Disposal Area. Copper is a metal that occurs naturally throughout the environment, in rocks, soil, water, and air. Copper is an essential element in plants and animals (including humans), which means it is necessary for us to live. Therefore, plants and animals must absorb some copper from eating, drinking, and breathing. Copper is used to make many different kinds of products like wire, plumbing pipes, and sheet metal. Copper compounds are commonly used in agriculture to treat plant diseases like mildew, for water treatment and, as preservatives for wood, leather, and fabrics. Everyone must absorb small amounts of copper every day because copper is essential for

good health. High levels of copper can be harmful. Breathing high levels of copper can cause irritation of your nose and throat. Ingesting high levels of copper can cause nausea, vomiting, and diarrhea. The EPA has determined that copper is not classifiable as to human carcinogenicity.

**Lead:** A COC in subsurface soil in the Disposal Area. Lead is a naturally occurring, bluish-gray metal found in small amounts in the earth's crust. It does not dissolve in water and does not burn. Lead has been used commercially in batteries, sheet metal, soldering, ceramic glazes, and paints. Low levels of lead are common in human food, air, and water. Adult exposures to high levels of lead are known to adversely affect blood pressure, memory, the brain, and kidneys, and to cause anemia and blood disorders. Lead is not known to cause cancer in humans. High exposures to lead are toxic to unborn and young children by affecting their intelligence quotient (IQ). EPA regulates lead as a special case using a bloodlead uptake model to determine target concentrations protective of children and adults.

**Tetrachloroethene (PCE):** A COC in subsurface soil in the Disposal Area and in the groundwater of the fluvial aquifer. PCE is most commonly used for dry-cleaning textiles and for metal degreasing. Occupational exposures are most common among workers at dry cleaning facilities. High exposures can cause effects on the central nervous system, leading to dizziness, headache, sleepiness, confusion, nausea, and difficulty in coordination and speech. Exposure of PCE at high levels (considerably higher than detected at the Depot) can cause unconsciousness and death. In animal experiments with exposure to long-term higher-than-typical environmental concentrations, PCE is shown to cause liver and kidney damage, developmental effects, liver cancer, and leukemia. Based on animal evidence PCE is presumed to be capable of causing cancer in humans, however, human exposure data do not conclusively indicate that it is carcinogenic.

**Trichloroethene (TCE):** A COC in subsurface soil in the Disposal Area and in the groundwater of the fluvial aquifer. TCE is a halogenated organic compound used historically as a solvent and degreaser in many industries. Exposure to this compound has been associated with deleterious health effects in humans, including anemia, skin rashes, diabetes, liver conditions, and urinary tract disorders. Based on laboratory studies, TCE is considered a probable human carcinogen.

**1,1,2,2-Tetrachloroethane (1,1,2,2-PCA):** A COC in subsurface soil in the Disposal Area and in the groundwater of the fluvial aquifer. 1,1,2,2-PCA is a manufactured chemical historically used to make other chemicals, as a solvent, to clean and degrease metals, and in paints and pesticides. Commercial production for these uses has stopped in the U.S. and it is currently only used as an intermediate in the production of other chemicals. 1,1,2,2-PCA can be found at low levels in indoor and outdoor air. In closed environments, inhalation of high levels of 1,1,2,2-PCA can cause fatigue, vomiting, dizziness, and possible unconsciousness. Exposure to large amounts over long periods in time can cause liver damage, stomachaches, or dizziness. The health effects to long-term exposure to low levels are unknown. Based on animal studies, 1,1,2,2-PCA is a possible human carcinogen.

**1,1,2-Trichloroethane (1,1,2-TCA):** A COC in subsurface soil in the Disposal Area and in the groundwater of the fluvial aquifer. 1,1,2-TCA is an insoluble, colorless, liquid used as a solvent, as an intermediate in the production of 1,1-DCA, or as an impurity in other chemicals. Most 1,1,2-TCA in the environment is released into the air. Exposure of 1,1,2-TCA to the skin causes stinging and burning. Based on animal studies, inhalation of 1,1,2-TCA at high levels effected the liver, kidneys, and nervous system and ingestion of 1,1,2-DCE affected the stomach, blood, liver, kidneys, and nervous system. There is no information as to whether 1,1,2-TCA is a carcinogen.

**1,1-Dichloroethene (1,1-DCE):** A COC in the groundwater of the fluvial aquifer. 1,1-DCE is an colorless liquid that is used to make plastics, packaging materials, flame retardant coatings for fiber and carpet backings, coating for steel pipes, and in adhesive applications. Occupational exposures may occur to workers in industries who make or use 1,1-DCE. Long-term inhalation of 1,1-DCE may damage the human nervous system, liver, and lungs. Short-term exposure to high levels may damage the central nervous system. Contact of 1,1-DCE on skin or in the eyes causes irritation. 1,1-DCE has recently been reclassified by EPA as a non-carcinogen.

**1,2-Dichloroethene (1,2-DCE):** A COC in subsurface soil in the Disposal Area and in the groundwater of the fluvial aquifer. 1,2-DCE is a highly flammable, colorless, liquid that is present in two forms: cis-1,2-DCE and trans-1,2-DCE. It is commonly used to produce solvents and chemical mixtures. In the environment, it may break down into vinyl chloride. Short-term inhalation of 1,2-DCE at high levels can cause drowsiness, nausea, and fatigue. Inhalation of very high levels may cause death. Exposure to lower doses of cis-1,2-DCE can cause a decrease in red blood cells and affect the liver. Long term human health effects after exposure to low levels of 1,2-DCE are unknown. Cis-1,2-DCE is not classifiable as a human carcinogen and trans-1,2-DCE is not classified.

**Carbon Tetrachloride (CT):** A COC in subsurface soil in the Disposal Area and in the groundwater of the fluvial aquifer. Carbon tetrachloride is most often found as a colorless gas. It was historically used in the production of refrigeration fluid and propellants for aerosol cans, and as a pesticide, as a cleaning fluid, as a degreasing agent, in fire extinguishers, and in spot removers. Presently, these uses are now banned and carbon tetrachloride is only used in some industrial applications. Exposure to high levels through inhalation, ingestion, and possibly skin contact, can cause liver, kidney, and central nervous system damage. In severe cases, coma and death can occur. Carbon tetrachloride may reasonably be anticipated to be a carcinogen, however it is inconclusive.

**Chloroform (CF):** A COC in subsurface soil in the Disposal Area and in the groundwater of the fluvial aquifer. Chloroform is a colorless liquid that is presently used to make other chemicals and may be formed in small amounts when chlorine is added to water. Short-term inhalation of 900 ppm of chloroform in air can cause dizziness, fatigue, and headache. Long-term exposure to high levels through breathing or ingestion may damage the liver and kidneys. Exposure of large amounts to the skin may cause sores. Chloroform may be reasonably anticipated to be a carcinogen.

**Vinyl Chloride (VC):** Vinyl chloride is a colorless, flammable, gas used to make polyvinyl chloride (PVC), which is used in plastics and furniture and automobile upholstery. Vinyl chloride also results from the breakdown of other substances, such as TCA, TCE, and PCE. Short-term inhalation of high levels of vinyl chloride can cause dizziness or sleepiness; inhalation of extremely high levels can cause unconsciousness or death. Long-term inhalation can cause changes to the structure of the liver. Exposure to skin will cause numbness, redness, and blisters. Workers have developed nerve damage and immune reactions, problems with blood flow in the hands, and destruction of bones in the tips of fingers. Vinyl chloride is a known carcinogen.

**Polycyclic Aromatic Hydrocarbons (PAHs):** A COC in surface soil in the Disposal Area for future residential use. PAHs are a group of over 100 different chemicals formed during the incomplete burning of coal, oil, and gas, garbage, or other organic substances like tobacco or charbroiled meat. PAHs are found in coal tar crude oil, creosote, and roofing tar; some are used in medicines, to make dyes, plastics, and pesticides. Occupation exposures are possible for people who work in coke, coal-tar, and asphalt plants, smokehouses, and municipal trash incineration facilities. Animals studies show that short and long term exposure to PAHs may cause harmful effects on skin, bodily fluids, and the immune system, impact fertility, and cause birth defects; however, these impacts have not been seen in humans. Long-term exposures to PAHs with other chemicals have caused cancer and some PAHs may be reasonably expected to be carcinogen.

## References:

Agency for Toxic Substances and Disease Registry. ToxFAQs. [www.atsdr.cdc.gov/toxfaq.html](http://www.atsdr.cdc.gov/toxfaq.html)

CH2M Hill. *Rev. 2 Dunn Field Proposed Plan*. May 2003.

CH2M Hill. *Final Dunn Field Record of Decision*. Sections 1.4 and 2.7.1, Tables 2-6, 2-19 and 2-21E. March 2004.

CH2M Hill. *Final Dunn Field Disposal Sites Remedial Design*. Table 5-1. April 2004.